

What is claimed is:

CLAIMS:

- 1) A method for generating a data signal associated with an alphanumeric character to be produced using an apparatus having a control circuit, at least one controller movable in a plurality of directions such that when the at least one controller is moved in one of the directions the data signal associated with the alphanumeric character is generated, the method comprising:  
5 moving a first controller in a direction associated with a location on a QWERTY keyboard layout of the alphanumeric character to be produced.
- 2) The method of claim 1 further comprising:  
moving a second controller in the direction associated with the location on the  
10 QWERTY keyboard layout of the alphanumeric character to be produced.
- 3) The method of claim 1 further comprising:  
moving a second controller in a direction associated with a relative frequency of use of the alphanumeric character to be produced.
- 15 4) The method of claim 1 further comprising:  
moving the first controller and a second controller to activate one of a "Ctrl" sticky key function and an "Alt" sticky key function;  
moving the first controller and the second controller to generate data signals associated with at least one alphanumeric character indicative of an executable  
20 function; and  
moving the first controller and the second controller to deactivate the activated sticky key function to execute the executable function.
- 5) The method of claim 1 wherein the plurality of directions define respective points of a compass and wherein a second controller is moved in at least one of a north  
25 direction, a south direction, an east direction and a west direction.

6) The method of claim 1 further comprising:

moving a second controller in a direction associated with a location on the QWERTY keyboard layout of the alphanumeric character to be produced relative to a position of a user's fingers when placed on a set of home row keys of the QWERTY keyboard layout.

7) A method for generating a data signal associated with an alphanumeric character to be produced, the method for use with an apparatus having a control processor, at least one controller movable in a plurality of directions defining respective points of a compass such that when the at least one controller is moved in one of the directions the data signal associated with the alphanumeric character is generated, the method comprising:

moving a first controller in at least one direction selected from the group of:

a direction associated with a location on a QWERTY keyboard layout of the alphanumeric character to be produced;

a direction associated with a relative frequency of use of the alphanumeric character to be produced; and

at least one of a north direction, a south direction, a west direction and an east direction.

8) The method of claim 7 further comprising:

moving a second controller in at least one direction selected from the group of:

a direction associated with a location on a QWERTY keyboard layout of the alphanumeric character to be produced;

a direction associated with a relative frequency of use of the alphanumeric character to be produced; and

at least one of a north direction, a south direction, a west direction and an east direction.

9) An apparatus for generating a data signal, the apparatus comprising:  
a housing;

means for coupling a first controller to the housing so that the first controller may move from a home position to a plurality of positions radially extending from the home position;

means for guiding the first controller among the home position and the plurality of positions radially extending from the home position; and

means for sensing a position of the first controller and generating the data signal in response to the first controller being moved from the home position to one of the plurality of positions.

10) The apparatus of claim 9 further comprising:

means for coupling a second controller to the housing so that the second controller may move within the housing from a home position to a plurality of positions radially extending from the home position;

means for guiding the second controller among the home position and the plurality of positions radially extending from the home position;

means for sensing a position of the second controller; and

a processing module configured to receive a position signal from the means for sensing a position of the first controller and a position signal from the means for sensing a position of the second controller and convert the received position signals into the data signal wherein the data signal is indicative of an alphanumeric character.

11) The apparatus of claim 9, the means for coupling a first controller to the housing comprising:

a dome plate coupled with the first controller, the plate including a plurality of cantilever arms that matingly engage an upper surface of the housing to create a bias when the first controller is coupled to the housing; and

a director plate coupled with the dome plate, the director plate including a post affixed to a cantilever arm that fits within an aperture formed in the dome plate when the dome plate and director plate are coupled together.

12) The apparatus of claim 11, the means for guiding the first controller among the home position and the plurality of positions radially extending from the home position comprising:

5 a guide plate positioned beneath the director plate, the guide plate include a pair of slots for receiving a pair of respective guide posts affixed to an underside of the director plate when the apparatus is assembled;

a plurality of guide walls affixed to a bottom portion of the housing for receiving respective ones of a plurality of guide rails affixed to the underside of the director plate  
10 when the apparatus is assembled;

a first ball plunger affixed to the bottom portion of the housing; and

an impression formed in the underside of the director plate defining the plurality of positions radially extending from the home position wherein the first ball plunger engages the impression when the apparatus is assembled.

15 13) The apparatus of claim 11, the means for guiding the first controller among the home position and the plurality of positions radially extending from the home position further comprising:

a second ball plunger affixed to the bottom portion of the housing; and

a concave impression formed in the underside of the director plate wherein the  
20 second ball plunger engages the concave impression when the apparatus is assembled.

14) The apparatus of claim 9, the means for sensing a position of the first controller and generating the data signal in response to the first controller being moved from the home position to one of the plurality of positions comprising:

25 a position sensing means within the housing;

a shaft pivotally extending from the position sensing means; and

a director plate coupled with the first controller, the director plate including an aperture for receiving the shaft so that the shaft moves in response to movement of the first controller.

15) The apparatus of claim 9, the means for coupling a first controller to the housing so that the first controller may move from a home position to a plurality of positions radially extending from the home position comprising:

- 5           a recess formed in an underside of the first controller; and  
          a shaft pivotally extending from a sensing means contained within the housing wherein the shaft extends into the recess to couple the first controller to the housing.

16) The apparatus of claim 15, the means for guiding the first controller among the home position and the plurality of positions radially extending from the home position comprising:

- 10           a nub affixed to a base piece of the first controller; and  
          an impression formed on an underside of the housing defining the plurality of positions radially extending from the home position wherein the nub engages the impression when the apparatus is assembled for guiding the first controller.

17) The apparatus of claim 9, the means for guiding the first controller among the home position and the plurality of positions radially extending from the home position comprising:

- 15           a base plate affixed to the first controller;  
          a first ball plunger affixed within the housing; and  
20           an impression formed within a bottom surface of the base plate defining the plurality of positions radially extending from the home position wherein the first ball plunger engages the impression when the apparatus is assemble for guiding the first controller.

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18) The apparatus of claim 17, the means for guiding the first controller among the home position and the plurality of positions radially extending from the home position further comprising:

a second ball plunger affixed within the housing; and

5 a concave impression formed within the bottom surface of the base plate wherein the second ball plunger engages the concave impression when the apparatus is assembled.

19) The apparatus of claim 9, the means for guiding the first controller among the home position and the plurality of positions radially extending from the home position comprising:

10 an impression formed within a concave surface located beneath the first controller, the impression defining the plurality of positions radially extending from the home position; and

15 a guide ball pivotally extending from a position sensing means affixed within the housing, the guide ball having a guide knob formed thereon that engages the impressions when the apparatus is assembled for guiding the first controller.

20) The apparatus of claim 19, the means for guiding the first controller among the home position and the plurality of positions radially extending from the home position further comprising:

20 means for biasing the impression and the guide ball together.

21) A method for generating a data signal indicative of an alphanumeric character selected from a set of characters to be input into a computing device, the method for use with an apparatus having a processing means and at least one controller movable in a plurality of directions for causing the data signal to be generated  
5 and wherein the set of characters are arranged in a layout, the method comprising:  
moving at least one controller in a direction selected from the group of:  
a direction associated with a location on the layout of the alphanumeric character to be produced; and  
a direction associated with a relative frequency of use of the alphanumeric  
10 character.

22) An apparatus for generating a data signal, the apparatus comprising:  
a housing;  
at least one controller moveably coupled with the housing;  
a kinematic map plate moveable in response to movement of the at least one  
15 controller;  
at least one impression formed in the kinematic map plate defining a number of directions that the at least one controller may be moved;  
a spider mechanism that cooperatively engages the at least one impression of the at least one controller to guide the at least one controller;  
20 an upper director plate for guiding the at least one controller in at least one direction;  
an actuator armature moveable in response to movement of the at least one controller;  
means for sensing a position of the at least one controller operatively coupled  
25 with the actuator armature;  
means for biasing the at least one controller so that it may be depressed and released and for biasing the spider mechanism against the kinematic map plate; and  
a processing means configured to receive a signal from the means for sensing a position of the at least one controller and generate the data signal.

23) The apparatus of claim 22 further comprising:

a second controller moveably coupled with the housing;

a second kinematic map plate moveable in response to movement of the second

5 controller;

at least one impression formed in the second kinematic map plate defining a number of directions that the second controller may be moved;

a second spider mechanism that cooperatively engages the at least one impression of the second kinematic map plate to guide the second controller;

10 means for engaging and disengaging the second spider mechanism with the at least one impression of the second kinematic map plate;

a second upper director plate for guiding the second controller in at least one direction;

15 an second actuator armature moveable in response to movement of the second controller;

second means for sensing a position of the second controller operatively coupled with the second actuator armature;

20 second means for biasing the second controller so that it may be depressed and released and for biasing the second spider mechanism against the second kinematic map plate;

means for switching the apparatus between a mouse mode and a keyboard mode, the switching means activatable by depressing and releasing the second controller; and

25 wherein the processing means is configured to receive a signal from the second means for sensing a position of the second controller and generate the data signal.

24) The apparatus of claim 23 wherein the at least one controller and the second controller are each formed having a contoured upper surface that substantially conforms to the palmer architecture of a human hand and wherein the at least one controller and the second controller are positioned within the housing to have a bilateral  
30 symmetry.



25) The apparatus of claim 23 wherein the at least one impression formed in the kinematic map plate and the second kinematic map plate form eight directions that the at least one controller and the second controller may be moved.

26) The apparatus of claim 23 further comprising:

5 means for switching the apparatus among a num lock mode, a shift mode and a caps lock mode, the switching means activatable by depressing and releasing the at least one controller and wherein the processing means is configured to generate a data signal indicative of an alphanumeric character.

10 27) The apparatus of claim 23, the means for engaging and disengaging the second spider mechanism with the at least one impression of the second kinematic map plate comprising a camming mechanism positioned within a center aperture of the second spider mechanism, the camming mechanism including a plurality of opposing camming surfaces that cooperatively engage a plurality of camming protuberances disposed in the center aperture of the second spider mechanism, the plurality of  
15 opposing camming surfaces and the plurality of camming protuberances configured to cause the spider mechanism to rotate approximately 45 degrees when the second controller is depressed and released.

28) The apparatus of claim 22, the means for sensing a position of the at least one controller comprising a strain gauge.

20 29) The apparatus of claim 22 further comprising:

a biasing means operatively coupling the actuator armature to the means for sensing a position of the at least one controller.

30) The apparatus of claim 29, the biasing means operatively coupling the actuator armature to the means for sensing a position of the at least one controller  
25 comprising a coil spring.

31) The apparatus of claim 28, the biasing means operatively coupling the actuator armature to the means for sensing a position of the at least one controller comprising a spring having curvilinear legs.

5 32) The apparatus of claim 31, the spring comprising eight curvilinear legs.

33) The apparatus of claim 32 wherein the spring is formed of a polymer composition.

34) The apparatus of claim 22, the means for biasing the at least one controller so that it may be depressed and released comprising a spring coupled with  
10 the spider mechanism and positioned on an upper surface of the upper director plate.

35) The apparatus of claim 22, the at least one impression comprising a centrally located indentation have a first depth and a plurality of grooves each having a second depth and extending radially from the centrally located indentation wherein the first depth is greater than the second depth.

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36) An apparatus for generating a data signal, the apparatus comprising:  
a housing;  
at least one control assembly coupled with the housing, the at least one control assembly comprising:

- 5           a controller;  
          a kinematic map plate coupled with the controller;  
          at least one impression having a plurality of grooves formed within the kinematic map plate;  
          a spider mechanism having at least one post that impinges upon the at least one  
10 impression for guiding the controller among a plurality of directions defined by the plurality of grooves;  
          an upper director plate seated within an annular rim formed in the housing, the annular rim defining a circumference of an aperture formed within the housing for receiving the at least one control assembly;  
15           a guide plate;  
          means for sensing a position of the controller; and  
          a control circuit configured to receive a position signal from the means for sensing a position of the controller and generate the data signal in response to receipt of the position signal.

20           37) The apparatus of claim 36, the means for sensing a position of the controller comprising:

- an actuator armature coupled with the spider mechanism to move in response to movement of the controller;  
          a biasing means coupled with the actuator armature; and  
25           a strain gauge coupled with the biasing means such that the biasing means exerts a force against the strain gauge in response to movement of the controller.

38) The apparatus of claim 37, the biasing means comprising a coil spring.

39) The apparatus of claim 37, the biasing means comprising a spring having curvilinear legs.

40) The apparatus of claim 39, the spring comprising eight curvilinear legs.

5 41) The apparatus of claim 39 wherein the spring is formed of a polymer composition.

42) The apparatus of claim 37 further comprising:  
means for biasing the controller so that it may be depressed and released.

10 43) The apparatus of claim 42, the means for biasing the controller so that it may be depressed and released comprising a plurality of compression springs fitted over a plurality of corresponding legs extending from the kinematic map plate that fit within a plurality of corresponding apertures formed in the actuator armature.

15 44) The apparatus of claim 37 further comprising:  
means for engaging and disengaging the spider mechanism with the kinematic map plate.

20 45) The apparatus of claim 44, the means for engaging and disengaging the spider mechanism with the kinematic map plate comprising a camming mechanism positioned within a center aperture of the spider mechanism, the camming mechanism including a plurality of opposing camming surfaces that cooperatively engage a plurality of camming protuberances disposed in the center aperture of the spider mechanism, the plurality of opposing camming surfaces and the plurality of camming protuberances configured to cause the spider mechanism to disengage from the kinematic map plate and be retained in a position below the kinematic map plate when the second controller is depressed and released a first time and wherein the spider mechanism is released

from the retained position and engages the spider mechanism when the controller is depressed and released a second time.

46) The apparatus of claim 36, the at least one control assembly further comprising:

5 means for selecting a reference direction for the controller.

47) The apparatus of claim 46, the means for selecting a reference direction for the controller comprising at least one tooth formed on an underside of the upper director plate and at least one recess formed within the annular rim for receiving the at least one tooth.

10 48) The apparatus of claim 36, the at least one control assembly further comprising:

means for adjusting the rotational position of the controller relative to the kinematic map plate.

15 49) The apparatus of claim 48, the means for adjusting the rotational position of the controller relative to the kinematic map plates comprising a plurality of teeth circumferentially disposed on an upper surface of the kinematic map plate that matingly engage a plurality of opposing teeth on an underside of the controller.

50) The apparatus of claim 36, the at least one control assembly further comprising:

20 means for biasing the controller so that it may be depressed and released;

means for engaging and disengaging the spider mechanism with the kinematic map plate;

means for selecting a reference direction for the controller;

25 means for adjusting the rotational position of the controller relative to the kinematic map plate; and

means for switching the apparatus among a num lock mode, a shift mode and a caps lock mode, the means for switching activatable by depressing and releasing the controller and wherein the data signal is indicative of an alphanumeric character.

5 51) The apparatus of claim 50, the at least one control assembly further comprising:

a base plate;

a central post extending through the upper director plate, the spider mechanism and the kinematic map plate;

a top cover plate attached to an upper end of the central post; and

10 a receptacle mounted to the at least one control assembly operatively coupled with the control circuit so that the control assembly may be removed from and operate remotely from the housing.

52) The apparatus of claim 36 further comprising:

a second control assembly, the second control assembly comprising:

15 a second controller;

a second kinematic map plate coupled with the second controller;

at least one impression having a plurality of grooves formed within the second kinematic map plate;

20 a second spider mechanism having at least one post that impinges upon the at least one impression for guiding the second controller among a plurality of directions defined by the plurality of grooves;

a second upper director plate seated within an annular rim formed in the housing, the annular rim defining a circumference of an aperture formed within the housing for receiving the at least one control assembly;

25 a second guide plate;

means for biasing the second controller so that it may be depressed and released;

means for engaging and disengaging the spider mechanism with the kinematic map plate;

means for switching the apparatus between a keyboard mode and a mouse mode;

means for sensing a position of the second controller; and

wherein the data signal is indicative of an alphanumeric character.

5           53) The apparatus of claim 52, the second control assembly further comprising:

means for selecting a reference direction for the second controller; and

means for adjusting the rotational position of the second controller relative to the second kinematic map plate.

10           54) The apparatus of claim 53 wherein the controller of the at least one control assembly and the second controller are formed having a contoured upper surface that substantially conforms to the palmer architecture of a human hand.

55) An apparatus for generating a data signal, the apparatus comprising:

a housing;

15           a first controller;

a first impression formed in a first one of a curvilinear surface of the housing and a curvilinear surface of the first controller, the first impression defining a plurality of directions that the first controller may be moved;

20           a first nub formed on a second one of the curvilinear surface of the housing and the curvilinear surface of the first controller so that the first nub engages the first impression to guide the first controller among the plurality of directions;

means for sensing movement of the first controller in the plurality of directions and generating a signal indicative of a direction of movement of the first controller; and

25           a processing module configured to generate the data signal in response to receipt of the signal indicative of a direction of movement.

56) The apparatus of claim 55, the means for sensing movement of the first controller in the plurality of directions and generating a signal indicative of a direction of movement comprising a potentiometer having a pivotally extending joystick affixed to the first controller.

5 57) The apparatus of claim 56 further comprising:

means for switching the apparatus between a keyboard mode and a mouse mode wherein the processing module is configured to generate the data signal indicative of an alphanumeric character, the means for switching activatable by depressing and releasing the first controller.

10 58) The apparatus of claim 56 further comprising:

means for switching the apparatus between a num lock mode, a shift mode and a cap lock mode wherein the processing module is configured to generate the data signal indicative of an alphanumeric character, the means for switching activatable by depressing and releasing the first controller.

15 59) The apparatus of claim 55 further comprising:

a second controller;

a second impression formed in a first one of a second curvilinear surface of the housing and a curvilinear surface of the second controller, the second impression defining a plurality of directions that the second controller may be moved;

20 a second nub formed on a second one of the second curvilinear surface of the housing and the curvilinear surface of the second controller so that the second nub engages the second impression to guide the second controller among the plurality of directions;

means for sensing movement of the second controller in the plurality of directions  
25 and generating a signal indicative of a direction of movement of the second controller;  
and



wherein the processing module is configured to generate the data signal in response to receipt of the signals indicative of a direction of movement of the first controller and the second controller.

60) The apparatus of claim 59 further comprising:

5 means for switching the apparatus between a keyboard mode and a mouse mode wherein the processing module is configured to generate the data signal indicative of an alphanumeric character, the means for switching activatable by depressing and releasing a first one of the first controller and the second controller.

61) The apparatus of claim 59 further comprising:

10 means for switching the apparatus between a num lock mode, a shift mode and a cap lock mode wherein the processing module is configured to generate the data signal indicative of an alphanumeric character, the means for switching activatable by depressing and releasing a second one of the first controller and the second controller.

62) An apparatus for generating a data signal, the apparatus comprising:

15 a housing;  
a first controller moveably coupled to the housing;  
an impression formed in a lower surface of the first controller defining a plurality of directions the first controller may be moved;  
a first spring-loaded plunger;  
20 a ball bearing affixed to an upper end of the first spring-loaded plunger so that the ball bearing engages the impression formed in the lower surface of the first controller for guiding the first controller among the plurality of directions;  
means for sensing movement of the first controller in the plurality of directions and generating a signal indicative of a direction of movement of the first controller; and  
25 a processing module configured to generate the data signal in response to receipt of the signal indicative of a direction of movement of the first controller.

63) The apparatus of claim 62, the means for sensing movement of the first controller in the plurality of directions and generating a signal indicative of a direction of movement of the first controller comprising a potentiometer having a pivotally extending joystick engaged with the first controller so that the joystick moves in response to movement of the first controller.

64) The apparatus of claim 63 further comprising:  
a concave recess formed in the lower surface of the first controller; and  
a ball affixed to an upper end of the joystick so that the ball engages the concave recess.

65) The apparatus of claim 62 further comprising:  
a concave impression formed in the lower surface of the first controller; and  
a second spring-loaded plunger that engages the concave impression.

66) The apparatus of claim 62 further comprising:  
means for switching the apparatus between a num lock mode, a shift mode and a cap lock mode, the means for switching activatable by depressing and releasing the first controller.

67) The apparatus of claim 62 further comprising:  
means for switching the apparatus between a keyboard mode and a mouse mode, the means for switching activatable by depressing and releasing the first controller.

68) The apparatus of claim 62 further comprising:  
a second controller moveably coupled to the housing;  
an impression formed in a lower surface of the second controller defining a plurality of directions the second controller may be moved;  
a second spring-loaded plunger;

a ball bearing affixed to an upper end of the second spring-loaded plunger so that the ball bearing engages the impression formed in the lower surface of the second controller for guiding the second controller among the plurality of directions;

means for sensing movement of the second controller in the plurality of directions  
5 and generating a signal indicative of a direction of movement of the second controller;  
and

wherein the processing module is configured to generate the data signal in response to receipt of the signals indicative of a direction of movement of the first controller and the second controller.

10 69) An apparatus for generating a data signal, the apparatus comprising:  
a housing;  
a first controller moveably coupled to the housing;  
a concave surface positioned on an underside of the first controller;  
an impression formed in the concave surface defining a plurality of directions the  
15 first controller may be moved;  
a potentiometer for sensing movement of the first controller and generating a signal indicative of a direction of movement of the first controller, the potentiometer having a pivotally extending joystick with a guide nub affixed to an upper end of the joystick that engages the impression;  
20 means for biasing the concave surface against the guide nub; and  
a processing module configured to generate the data signal in response to receipt of the signal indicative of a direction of movement of the first controller.

70) The apparatus of claim 69 further comprising:  
a plurality of extensions extending from the first controller;  
25 a base plate coupled with the first controller;  
an aperture formed in the base plate; and  
an insert within the aperture of the base plate wherein the concave surface is formed within the insert.

71) The apparatus of claim 70, the means for biasing the concave surface against the guide nub comprising a compression spring positioned between the first controller and the insert.

72) The apparatus of claim 69 further comprising:

5 a second controller moveably coupled to the housing;  
a concave surface positioned on an underside of the second controller;  
an impression formed in the concave surface defining a plurality of directions the second controller may be moved;

10 a potentiometer for sensing movement of the second controller and generating a signal indicative of a direction of movement of the second controller, the potentiometer having a pivotally extending joystick with a guide nub affixed to an upper end of the joystick that engages the impression;

means for biasing the concave surface against the guide nub; and

15 wherein the processing module is configured to generate the data signal in response to receipt of the signals indicative of a direction of movement of the first controller and the second controller.

73) The apparatus of claim 72 wherein the processing module is configured to generate the data signal indicative of an alphanumeric character in response to receipt of at least one of the signal indicative of a direction of movement of the first controller  
20 and the signal indicative of a direction of movement of the second controller.

74) A method of entering data into a hand-held computing device, the method comprising:

25 providing a pair of pressure responsive signal generating means integral with the computing device and generally adjacent to opposite side edges of the computing device;

holding the computing device in the hands of a user such that each of the pair of signal generating means is in contact with a respective thumb of the user; and

controlling the entering of data by exerting forces on the respective signal generating means through thumb pressure thereon.

75) The method of claim 74 further comprising:

- 5 providing the hand-held computing device with a processing module configured to receive signals from the signal generating means wherein the signals are indicative of an alphanumeric character for use with an application module executable by the hand-held computing device.